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The structure of common psychiatric symptoms: how many dimensions of neurosis?

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SYNOPSIS In order to replicate and elaborate the two-dimensional model of depression and anxiety underlying the structure of common psychiatric symptoms proposed by Goldberg *et al.* (1987), we carried out latent trait analyses on PSE symptom data of the original Manchester study and two recent Dutch studies. We used the same analytical strategy as Goldberg *et al.* to facilitate comparison with the earlier work. It was found that a more comprehensive set of common psychiatric symptoms caused an extra, third dimension to emerge, so that the earlier anxiety dimension became split between a specific anxiety axis characterized by situational and phobic anxiety and avoidance, and a non-specific anxiety axis characterized by free-floating anxiety, various symptoms relating to tension, irritability and restlessness. It is argued that three dimensions are sufficient to account for the covariance between common psychiatric symptoms. A fairly consistent correlation between the non-specific anxiety and the depression dimension was found across sites, as well as independence of the specific anxiety dimension from the other two dimensions. Furthermore, the depression dimension was robust with similar symptom profiles across samples, but there appeared to be local differences in the structure of anxiety symptoms.

INTRODUCTION

The first application of latent trait analysis to population-based symptom data obtained with standardized psychiatric interviews was by Goldberg *et al.* (1987). They demonstrated that only two dimensions accounted for the shared variance between common psychiatric symptoms. The two dimensions were highly correlated ($+0.70$), and comprised anxiety-related symptoms on the one hand, and depressive symptoms on the other. After taking out the covariance among the symptoms that could be explained by the two-dimensional model, little covariance was left, indicating that additional dimensions were not needed. Goldberg *et al.* also found in their Manchester study that less common symptoms did not form a dimen-

sion of their own but appeared as more severe expressions of the underlying dimensions of depression and anxiety. There were no points of rarity between the symptoms which went to make up one cluster or the other. Thus, while it is always possible to apply arbitrary decision rules to determine 'caseness', it was argued that there is an unbroken continuum of cases with various combinations of the two sets of symptoms.

However, some limitations of the Manchester study among primary care attenders warrant replication and elaboration. First, results of the Manchester study are limited by the sample size ($N = 283$), the low prevalence of more severe cases, and the low prevalence of particular symptoms. It is conceivable that additional dimensions are needed to account for the associations among the symptoms if either more symptoms are included or more severe cases or both. Symptoms were omitted from the

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Manchester analysis if fewer than 10 people complained of them, and this caused the omission of suicidal ideas, slow speech, guilty ideas of reference, agitation at interview, self-neglect, increased sleep, anxious foreboding and various symptoms of panic. Analysing a larger sample might allow inclusion of some of these symptoms. Secondly, the interpretation of the anxiety dimension is not unequivocal, since some key anxiety symptoms such as phobic anxiety, situational anxiety and autonomic anxiety on meeting people failed to load on the anxiety dimension. The items that loaded best on the anxiety dimension were related to subjective tension, tension pains and various kinds of worry. Thirdly, factor analytical studies suggest a tripartite model of common psychiatric symptoms consisting of negative affectivity, anxiety and depression (Clark & Watson, 1991). Therefore, it may be possible that the anxiety factor is insufficiently specific and might be broken down into a general distress or tension dimension and another more specific anxiety dimension.

The present study addresses these issues, and attempts a replication and elaboration of the Manchester study in two further samples, one in the community and the other in primary care. To establish method equivalence, we used the same analytical strategy as in the Manchester study (i.e. latent trait analyses with NOHARM II), and symptom sets common to all three samples. The first symptom set encompasses the 27 symptoms included in the earlier Manchester analysis which were also present in the two Dutch samples. The second set of 32 symptoms represents the largest possible common symptom set. We examined the robustness of the two-dimensional model across samples, and carefully re-examined the possibility that an additional dimension might provide a better fit for the data.

METHOD

Subjects

The Manchester sample consisted of 283 patients drawn from a sample of 590 patients consulting their general practitioner with a new episode of illness (Goldberg *et al.* 1987). The Groningen sample consisted of 301 patients drawn from a series of 1994 consecutive attenders of 25 GPs in

a two-stage sampling design. In the first stage the patients were screened on psychiatric disorder by the GP and GHQ-30. A stratified random sample with differing probabilities depending on GP- and GHQ-status was selected for a second stage interview (Ormel *et al.* 1990, 1993). The Nijmegen sample consisted of 485 subjects from the general population in the Nijmegen area. In a two-stage sampling design, a random population sample of 3232 persons were screened with the GHQ-30. Again, a stratified random sample with differing probabilities depending on the GHQ-status was interviewed (Hodiamont *et al.* 1987). Subjects in all three studies aged 16 (or 18) to 64. Women outnumbered men in the two primary care studies.

Symptoms

It was not possible to perform an exact replication of the Manchester study since that study used data from the Psychiatric Assessment Schedule (PAS) which includes items needed to make DSM-III diagnoses, which are not included in the Present State Examination used in the two Dutch studies. Seven items – anxiety without autonomic symptoms, frequent thoughts of death, poor appetite, increased appetite, weight gain, poor sleep and self-pity – had to be excluded on these grounds. Two further items – observed anxiety and observed depression – had to be excluded because they had not been rated in the Dutch data. Our first symptom set therefore consisted of 27 items which had been used in the Manchester study and which were also present in the two Dutch studies. The second set of symptoms represents the largest possible common symptom set and includes the 27 symptoms of first set plus five symptoms which had been excluded from the original Manchester analysis. Two items had been excluded because fewer than 10 subjects complained of them i.e. anxious foreboding and pathological guilt. As these occurred more frequently in the Dutch studies, they were now included (Manchester, Nijmegen, Groningen: 7, 21, 18 and 9, 10, 15 respectively). Three further ratings – depression worse in mornings, premenstrual exacerbation and phobic avoidance – had been excluded from the Manchester study because they had not been thought to be typical symptoms of neurosis. As this is debatable, they

were now included because they were present in all three data-sets. It should be emphasized that three-point PSE ratings have been dichotomized at 0 *versus* 1 and 2. As a consequence minor degrees of a symptom are counted as abnormal, and we have occasionally altered the name of a symptom to reflect this: thus 'hypochondriasis' has become 'worry over health', and 'pathological guilt' was changed into 'over-guilty'.

Analysis

Latent trait analysis offers a number of advantages over conventional multivariate analysis in teasing out the relationships between psychiatric symptoms (Duncan-Jones *et al.* 1986; Grayson *et al.* 1987*a, b*; Wilmink, 1989), and is particularly suited for a multi-dimensional study of the underlying structure of associated dichotomous phenomena such as symptoms. The method of latent trait analysis (LTA) will be dealt with concisely here.

Latent trait analysis can be considered a form of dichotomous factor analysis, but starts from a different premise. It assumes a (uni- or multi-dimensional) latent space, the dimensions of which (the latent traits) can be thought of as representing aspects of some hypothetical construct. Individuals are characterized by their position on one or more latent traits. The traits are latent in that they cannot be observed directly, but have to be inferred by means of (dichotomous) test items, which in our case are psychiatric symptoms.

Each symptom can be represented by a function which gives the probability that an individual will be symptomatic given his or her position on the latent trait. This function is called the Item Characteristic Curve (ICC). The position on the latent trait, θ , can be thought of as the degree of illness severity. In the model used in the current and original Manchester analyses, the ICCs are assumed to be given by the (S-shaped) cumulative standard normal density function (ϕ). Furthermore, each ICC is described by two parameters: the 'threshold' or 'difficulty', indicating the position on the underlying severity dimension where 50% of the subjects will endorse the symptom; and the 'slope' or 'discriminatory value', which indicates how 'good' the symptom is as a measure of the underlying dimension. For a unidimensional model, the probability that a

person with a given illness severity θ endorses symptom i is given by

$$P_i(\theta) = \phi[a_i(\theta - b_i)],$$

where a_i and b_i are the symptom parameters (respectively, slope and threshold) and θ is the illness severity. The above discussion can be extended to the multi-dimensional situation by replacing the parameters a_i , b_i and θ by parameter vectors, containing separate values for each dimension. Under certain conditions, which will not be discussed here, it is possible to re-parameterize the latent trait model in terms of the more familiar common factor model. This approach allows slopes to be transformed to factor loadings.

To establish method equivalence with the original Manchester study, factor loadings were estimated with the same computer program NOHARM II (Fraser, 1986) as used in the original Manchester work (Goldberg *et al.* 1987). NOHARM II is capable of dealing with multi-dimensional two-parameter latent trait models. However, the program has some drawbacks, which still have to be solved. One limitation of the program is the assessment of goodness of fit. NOHARM provides two measures of goodness-of-fit. The first one is the root-mean-square (RMS) of the residual covariance of the symptoms, which can be considered an overall measure of the misfit of the model to the data. In the NOHARM manual, it is suggested that 'if the root-mean-square residual is in the order of the typical standard error of the residuals (four times the reciprocal of the square root of the sample size) we have a rough indication that a refined test of significance would not reject the hypothesized model'. However, this measure appeared to have hardly any discriminating power, since the RMS of any model we tried easily dropped below $4/\sqrt{n}$. The second measure of goodness-of-fit (GoF) is calculated as the ratio of the RMS of the model to the RMS under full independence and defined by

$$\text{GoF} = \frac{\sqrt{[\sum(p_{ij} - \hat{p}_{ij})^2]}}{\sqrt{[\sum(p_{ij} - p_i p_j)^2]}}$$

where p_{ij} is the observed proportion of individuals with a score of 1 on both item i and item j ; \hat{p}_{ij} is the model-based expected proportion of individuals with a score of 1 on both item i

Table 1. Symptom prevalence (percentages) of 32 PSE symptoms; among the Manchester primary care patients (N = 283), the Nijmegen community sample (N = 485) and the Groningen primary care sample (N = 301). All data are unweighted

PSE item (number, description)	Prevalence (%)		
	Primary care Manchester (N = 283)	Community Nijmegen (N = 485)	Primary care Groningen (N = 301)
9. Worry over health	26.1	12.0	7.0
35. Delayed sleep	24.0	17.5	26.6
11. Free-floating anxiety	29.7	9.5	15.3
5. Tension pains	35.0	35.7	38.9
7. Muscular tension	37.8	35.7	38.9
40. Irritability	48.4	37.3	43.9
10. Subjective nervous tension	52.7	42.1	41.9
4. Worrying	51.6	20.0	28.9
18. <i>Avoidance of anxiety-provoking situations*</i>	24.4	16.3	30.6
12. <i>Anxious foreboding</i>	2.5	4.3	6.0
36. Subjective anergia	29.7	21.6	30.2
6. Tiredness	40.6	30.5	29.9
8. Restlessness	15.5	33.2	18.6
17. Specific phobias	29.3	10.5	22.6
15. Situational anxiety	9.5	15.3	21.3
16. Social anxiety	5.7	6.4	20.6
31. Simple ideas of reference	13.8	7.6	13.3
23. Depressed mood	40.6	22.3	28.2
34. Weight loss due to poor appetite	10.6	8.5	13.0
21. Neglect due to brooding	10.6	16.9	18.6
38. Loss of libido	23.0	4.7	17.3
20. Poor concentration	21.6	15.1	20.3
30. Lack of self-confidence	11.0	17.3	16.6
33. <i>Over-guilty</i>	3.2	2.1	5.0
39. <i>Premenstrual exacerbation</i>	11.0	2.7	8.3
37. Early waking	6.7	6.2	8.6
28. Social withdrawal	11.3	14.0	12.3
19. Inefficient thinking	11.3	8.9	10.6
24. Hopelessness	10.2	16.7	5.3
29. Self-depreciation	17.3	10.3	14.3
22. Loss of interest	17.0	8.0	15.0
27. <i>Morning depression</i>	38.9	15.1	27.6

* Items used in our study (the extension part) but not by Goldberg *et al.* (1987) have been printed in italics.

and item j ; and p_i and p_j are the proportions of individuals with a score of 1 on, respectively, item i and item j .

From the formulae it follows that a lower GoF indicates a better fit of the model. Unfortunately, no statistical test for the fit of a model, or the comparison of two models, has been developed yet. Therefore, the GoF index can only be used relatively. i.e. to rank order models in terms of fit.

Another problem we encountered with NOHARM was that the program sometimes ran into local minima. We tried to overcome this problem by using varying starting values for the iteration process. Although the GoF index was not entirely insensitive to different starting

values, and hence should be interpreted very cautiously, the overall structure of the factor loadings was robust across runs with varying starting values.

In the present analyses, samples have not been weighted back since this would not benefit the analysis and be difficult to implement due to the complexity of the stratification procedures in the Dutch studies. It cannot be proven that the results of latent trait analysis are independent from the structure of two-stage samples. However, it is generally assumed that the underlying structure is the same in any population irrespective of symptom prevalences and the distributions on latent traits provided the model is correct, the distribution of the latent traits

Table 2. *Exploratory analyses on 27 symptoms using two dimensions; factor loadings*

	Primary care Manchester		Community Nijmegen		Primary care Groningen	
	Anxiety	Depression	Anxiety	Depression	Anxious depression	???
Worry over health	0.88*	-0.27	0.27	0.26	0.68	-0.38
Delayed sleep	0.59	0.09	0.56	0.13	0.55	0.06
Free-floating anxiety	0.75	-0.01	0.59	0.13	0.30	0.52
Tension pains	0.88	-0.18	0.62	-0.12	0.51	0.22
Muscular tension	0.79	-0.03	0.90	-0.16	0.31	0.45
Irritability	0.79	0.08	0.39	0.20	0.56	0.06
Subj. nervous tension	0.86	0.04	0.79	-0.07	0.46	0.48
Worrying	1.01	-0.09	0.43	0.26	0.60	0.21
Subjective anergia	0.52	0.29	0.28	0.62	0.91	-0.90
Tiredness	0.56	0.34	0.48	0.36	0.77	0.08
Restlessness	0.54	0.19	0.88	-0.22	0.67	0.15
Specific phobias	0.34	-0.34	0.40	-0.10	-0.28	0.51
Situational anxiety	-0.12	0.54	0.47	-0.08	-0.13	0.69
Social anxiety	-0.12	0.64	0.16	0.33	-0.28	0.96
Simple ideas of reference	0.06	0.59	-0.27	0.81	-0.12	0.89
Depressed mood	0.21	0.79	0.52	0.37	0.86	0.13
Weight loss/poor appetite	0.24	0.34	0.36	0.39	0.55	0.01
Neglect due to brooding	0.30	0.44	0.24	0.57	0.94	-0.14
Loss of libido	0.26	0.44	0.17	0.57	0.23	0.44
Poor concentration	0.24	0.54	0.03	0.69	0.90	-0.09
Lack of self confidence	-0.30	1.03	-0.09	0.75	0.16	0.65
Early waking	0.33	0.24	0.38	0.11	0.55	-0.07
Social withdrawal	0.06	0.64	0.21	0.50	0.62	0.15
Inefficient thinking	0.22	0.48	-0.19	0.99	0.90	-0.17
Hopelessness	-0.01	0.76	0.15	0.63	0.60	0.28
Self depreciation	-0.14	0.95	-0.07	0.89	0.09	0.78
Loss of interest	0.14	0.71	0.08	0.75	0.96	-0.16
Goodness of Fit		0.187		0.179		0.188
Factor correlations		0.69		0.73		0.58

* Loadings of 0.50 or larger have been printed in bold typeface.

normal, and, most important here, subjects have been sampled from the whole range of values (Wilmink, 1989; Grayson, Hoitink, personal communications). The assumption of normality is not testable but Monte Carlo studies suggest that the method in practice is quite robust against violations of the normality assumption (NOHARM manual). The requirement of sampling from the whole range is certainly met in our data, because the non-proportional sampling proportions from the various GHQ strata were designed only to reduce the number of subjects with none or relatively few symptoms. Although successful in this, the samples still include a sufficiently large number of subjects with none or relatively few symptoms (Goldberg *et al.* 1987; Hodiament *et al.* 1987; Wilmink, 1989). The empirical results support this position as we found the very same two-dimensional

structure in the unweighted Manchester data as Goldberg *et al.* (1987) reported for their weighted data.

RESULTS

Descriptive results

The prevalences reported in Table 1 relate to the sample interviewed, and not to the population from which they were drawn. As described in the Method section in general terms, the sampling procedures were stratified and non-proportional and will have resulted in under-sampling of patients with none or relatively few symptoms. It can be seen that the primary care patients generally have higher symptom levels than the community sample. Where the two primary care samples are concerned, it is noteworthy that situational and social anxiety are more prevalent

Table 3. *Exploratory analyses on 32 symptoms using two dimensions; factor loadings*

	Primary care Manchester		Community Nijmegen		Primary care Groningen	
	Anxious depress.	Phobic avoidance	Anxious depress.	Phobic avoidance	Anxious depress.	Phobic avoidance
Worry over health	0.14	0.83*	0.67	-0.36	0.75	-0.45
Delayed sleep	0.43	0.31	0.66	-0.05	0.61	-0.10
Free-floating anxiety	0.39	0.46	0.58	0.16	0.38	0.32
Tension pains	0.30	0.60	0.73	-0.52	0.55	0.17
Muscular tension	0.45	0.38	0.71	-0.00	0.48	0.23
Irritability	0.57	0.39	0.61	-0.09	0.55	-0.31
Subj. nervous tension	0.72	0.31	0.74	-0.09	0.61	0.34
Worrying	0.44	0.64	0.64	0.00	0.66	0.11
Avoidance of anx. prov. sit.	-0.45	0.92	-0.08	0.79	-0.11	0.81
Anxious foreboding	0.60	0.11	0.65	0.27	0.39	0.14
Subjective anergia	0.58	0.25	0.75	0.23	0.88	-0.20
Tiredness	0.73	0.18	0.82	-0.08	0.81	-0.01
Restlessness	0.46	0.33	0.55	0.17	0.70	-0.05
Specific phobias	-0.51	0.82	0.03	0.58	-0.19	0.64
Situational anxiety	0.33	0.12	-0.11	0.75	-0.26	0.66
Social anxiety	0.30	0.19	0.19	0.52	0.08	0.67
Simple ideas of reference	0.61	0.00	0.34	0.27	0.25	0.48
Depressed mood	0.95	0.01	0.84	0.16	0.87	0.15
Weight loss/poor appetite	0.63	-0.12	0.49	0.35	0.54	0.05
Neglect due to brooding	0.71	-0.04	0.58	0.30	0.87	-0.04
Loss of libido	0.65	-0.01	0.66	0.14	0.44	0.21
Poor concentration	0.77	-0.08	0.52	0.26	0.85	-0.05
Lack of self-confidence	0.68	-0.07	0.52	0.09	0.39	0.35
Over-guilty	0.50	0.16	0.67	0.18	0.25	0.19
Premenstrual exacerbation	0.40	0.14	0.49	0.21	0.38	0.25
Early waking	0.46	0.11	0.52	-0.14	0.52	0.08
Social withdrawal	0.70	-0.07	0.46	0.37	0.54	0.15
Inefficient thinking	0.64	-0.03	0.68	0.07	0.80	0.00
Hopelessness	0.78	-0.10	0.70	0.08	0.74	0.13
Self-depreciation	0.92	-0.31	0.62	0.25	0.30	0.44
Loss of interest	0.89	-0.16	0.71	0.14	0.87	-0.01
Morning depression	0.94	0.03	0.82	0.19	0.87	0.15
Goodness of Fit	0.248		0.246		0.298	
Factor correlations	0.50		0.42		0.50	

* Loadings of 0.50 or larger have been printed in bold typeface.

in the Dutch sample, whereas most items relating to general anxiety and depression are more prevalent in the English sample.

Replication (27 PSE-items)

The Manchester data for the reduced item-set show a factor structure very similar to the structure reported earlier, with the first 11 items having loadings greater than 0.5 on the anxiety dimension and 10 items loading on the depression dimension (Table 2). The Dutch community sample shows a broadly similar structure, with 7 of the 10 depression items, and 6 of the 11 anxiety items being the same. Some symptoms change dimension. The differences concern irritability, health worries, worrying and subjective anergia which no longer load on anxiety and, on the other hand, situational anxiety and depressed

mood which have higher loadings on the anxiety dimension. However, the Groningen primary care sample shows a strikingly different structure, with the general anxiety and depressive items all loading on a single factor, whereas the second factor consists of social anxiety, simple ideas of reference, self-depreciation, situational anxiety, lack of self-confidence, free-floating anxiety and specific phobias. For all three samples, the GoF statistics suggest a fit which may be considered good according to the rule of thumb of 0.2. The studies show similar correlations between the two dimensions.

Extension (32 PSE-items)

It can be seen from Table 3 that the extended data-set allows these differences to be resolved, since the inclusion of the item relating to

Table 4. *Exploratory analyses on 32 symptoms using three dimensions; factor loadings*

	Primary care Manchester			Community Nijmegen			Primary care Groningen		
	GA*	DEP*	PA*	GA	DEP	PA	GA	DEP	PA
Worry over health	0.61 †	-0.02	0.01	0.33	0.19	-0.13	-0.19	0.65	-0.19
Delayed sleep	0.55	0.07	0.13	0.61	0.01	-0.05	0.29	0.35	-0.14
Free-floating anxiety	0.76	-0.10	-0.21	0.42	0.01	0.27	0.54	0.01	0.18
Tension pains	0.95	-0.31	0.11	0.90	-0.13	-0.50	0.49	0.14	0.01
Muscular tension	0.93	-0.25	0.05	0.90	-0.27	0.05	0.87	-0.29	0.06
Irritability	0.95	-0.18	-0.12	0.39	0.14	-0.06	0.52	0.14	-0.18
Subj. nervous tension	1.09	-0.27	0.09	0.85	-0.27	0.06	1.00	-0.26	0.05
Worrying	0.85	-0.03	-0.13	0.50	0.19	-0.16	0.25	0.44	0.07
Avoidance	-0.01	0.15	0.98	-0.11	-0.15	0.94	-0.20	0.05	0.98
Anxious foreboding	0.18	0.42	0.06	0.17	0.29	0.29	0.16	0.14	0.37
Subjective anergia	0.45	0.26	-0.11	-0.02	0.67	0.10	0.33	0.59	-0.29
Tiredness	0.48	0.29	-0.13	0.46	0.29	-0.08	0.33	0.50	-0.10
Restlessness	0.43	0.22	0.09	0.96	-0.50	0.22	0.74	0.09	-0.22
Specific phobias	-0.03	0.09	0.92	-0.07	-0.10	0.67	-0.17	0.03	0.57
Situational anxiety	0.01	0.32	0.25	-0.09	-0.28	1.01	0.11	-0.38	0.92
Social anxiety	0.19	0.16	0.46	-0.06	0.05	0.63	0.03	0.03	0.74
Simple ideas of ref.	0.05	0.50	0.22	-0.34	0.64	0.15	0.08	0.10	0.73
Depressed mood	0.09	0.75	0.21	0.33	0.45	-0.03	0.13	0.77	0.03
Weight loss/poor app.	0.20	0.28	-0.29	0.12	0.36	0.20	0.02	0.55	-0.06
Neglect/brooding	0.25	0.38	-0.15	0.22	0.42	0.01	-0.05	0.87	-0.05
Loss of libido	0.34	0.26	-0.18	-0.09	0.68	-0.03	0.53	-0.09	0.15
Poor concentration	0.08	0.57	-0.45	0.01	0.56	-0.02	0.12	0.73	-0.12
Lack of self-confid.	-0.17	0.76	-0.19	-0.02	0.57	-0.08	0.02	0.40	0.35
Over-guilty	0.06	0.51	0.26	0.17	0.33	0.19	0.12	-0.02	0.67
Premenstrual exacerb.	0.61	-0.18	0.22	0.10	0.22	0.32	0.27	-0.04	0.30
Early waking	0.12	0.36	-0.07	0.57	0.01	-0.24	-0.03	0.61	-0.22
Social withdrawal	-0.14	0.74	0.22	0.21	0.35	0.03	0.09	0.58	0.02
Inefficient thinking	0.05	0.50	-0.57	-0.21	0.86	-0.08	0.07	0.78	-0.19
Hopelessness	-0.38	1.02	-0.01	-0.26	1.01	-0.19	-0.39	1.04	0.17
Self-depreciation	-0.12	0.77	0.07	-0.15	0.77	0.03	0.12	0.24	0.60
Loss of interest	-0.38	1.09	-0.04	-0.29	1.07	-0.21	-0.44	1.19	0.14
Morning depression	0.11	0.73	0.21	0.13	0.59	0.04	0.12	0.77	0.04
Goodness of Fit		0.197			0.192			0.213	
Factor correlations		$r_{(GA-DEP)} = 0.55$ $r_{(GA-PA)} = -0.16$ $r_{(DEP-PA)} = -0.15$			$r_{(GA-DEP)} = 0.52$ $r_{(GA-PA)} = 0.13$ $r_{(DEP-PA)} = 0.36$			$r_{(GA-DEP)} = 0.58$ $r_{(GA-PA)} = 0.05$ $r_{(DEP-PA)} = -0.17$	

† Loadings of 0.50 or larger have been printed in bold typeface.

* 'GA' indicates generalized anxiety; 'DEP', depression; and 'PA', phobic anxiety.

avoidance of phobic situations causes the second dimension in all samples to be identified with avoidance of anxiety-provoking situations and specific phobias, with the first, major factor relating to generalized anxiety and depression. It is noteworthy that in Manchester the second dimension relates to specific phobias and avoidance combined with worrying, tension pains and worry over health; whereas in the Dutch community and primary care sample the specific phobias and avoidance are accompanied by situational and social anxiety.

The fit of this two-dimensional model on 32 symptoms is worse compared to the two-dimensional solution using 27 symptoms. For each sample the GoF is now above 0.2, suggesting that more dimensions are needed to account satisfactorily for the covariance among the 32 symptoms.

Table 4 explores the effects of allowing three dimensions to emerge. It can be seen that a robust depression dimension, characterized by loss of interest, hopelessness, morning depression, inefficient thinking, poor concentration and lack of self-confidence, now emerges at all sites. Phobic avoidance and specific phobias too can now be found on the same dimension at all sites, implying a dimension which may best be labelled 'phobic anxiety'. It is remarkable that situational and social anxiety show much higher loadings in the Dutch samples than in the Manchester sample. The main dimension of anxiety now emerges as a first factor strongly in Manchester and fairly strongly in the Dutch community and primary care samples. The common items identifying the 'anxiety' dimension relate to subjective nervous tension, muscular tension, tension pain, irritability, delayed sleep and restlessness. The most appropriate label seems to be 'generalized anxiety', to stress the difference with the more specific anxiety in the 'phobic anxiety' dimension.

In all samples the generalized anxiety and depression axes are substantially correlated (around 0.55), while the correlations between the generalized anxiety and phobic anxiety axes are negligible. The depression and phobic anxiety axes are also uncorrelated in the Manchester and Groningen samples but show some association in the Nijmegen sample. The fit of the three-dimensional model is rather good; the GoF indices fluctuate around 0.2.

We also examined a four-dimensional model, but the results were unstable and inconsistent across sites and therefore discarded.

DISCUSSION

After the earlier analysis of the Manchester data, Goldberg *et al.* (1987) concluded that only two dimensions were required to describe adequately the underlying structure of common psychiatric symptoms. They found the three-dimensional solution not to be any better than the two-dimensional solution in terms of the GoF and interpretation. However, the present analyses show that a more comprehensive set of common psychiatric symptoms allows a third dimension to emerge which is reasonably stable, consistent across the three samples, and readily interpretable.

This third dimension is concerned with phobic anxiety. The two items which are shared on this dimension are specific phobias and phobic avoidance. It is hardly surprising that this dimension did not emerge in the earlier analysis, since only one of these items was included. In both Dutch samples, situational and social anxiety also load on this dimension, but in Manchester these two do not load on any of the dimensions, perhaps due to their low prevalence in Manchester. In the Dutch community sample only these four items load on the phobic anxiety dimension, but in the Dutch primary care sample three further items appear: simple ideas of reference, over-guilt and self-depreciation. These symptoms seem to form a meaningful cluster related to ideas about the self in relation to other people. This may correspond to the tendency of some patients to avoid going out because they have low self-esteem: a state that is recognized by clinicians in Groningen with whom we have discussed our results. Thus, the phobic housewife feels guilty about not being able to take her children to school, or having to ask her husband to do the shopping for her. These feelings need not be part of a depressive syndrome. The result might also be related to the way in which the symptoms were dichotomized for the present study, with minor degrees of a symptom being counted alongside the fully expressed symptom. The other anxiety dimension is concerned with generalized anxiety as indicated by nervous tension, tension pains

and muscular tension, and is often related to worrying, restlessness and delayed sleep. Free-floating anxiety and irritability load on this dimension in two of the three samples. The depression dimension appears to be reasonably robust between samples. Symptoms have also identical loadings on it, although, as we described above, some symptoms related to ideas about the self in relation to others (over-guilty, self-depreciation and simple ideas of reference) load on the phobic anxiety dimension in the Dutch primary care sample. We are thus left with three axes, all with correlations between depression and generalized anxiety in the region of $+0.55$, and with a third axis representing phobic anxiety which may have additional items loading on it, showing predominantly low correlations with both the other axes.

The need for such a third axis does not negate the basic model that anxiety and depression are the major dimensions that underpin common psychiatric symptoms. It merely focuses attention on the complexity of the anxiety dimension. In the earlier Manchester analysis, phobic anxiety occupied an anomalous position in the two-dimensional space, far away from the other anxiety items and almost orthogonal to the depression axis. Phobic anxiety then did not form a dimension because major associated symptoms had been excluded from the analysis (e.g. avoidance), had a relatively low prevalence in Manchester (e.g. situational anxiety) or a relatively weak association with phobic anxiety (social anxiety). The phobic anxiety axis appears to be formed by the behavioural consequences of phobic and specific anxiety, and in at least one site to have certain cognitive associations as well. This is to be distinguished from a (generalized) anxiety dimension that is largely non-specific and is concerned with nervous tension, free-floating anxiety, restlessness and delayed sleep. It seems that some forms of anxiety are situation-specific and lead to certain behavioural consequences, while others are free-floating and associated with worry and various tension symptoms. The lack of relationship between the phobia dimension and the generalized anxiety and depression dimensions is presumably due to the fact that the mechanism of avoidance is effective in relieving distress.

The distinction of anxiety into two uncorrelated (sub)dimensions is plausible from

a psychobiological point of view as well (Kandel, 1991). On clinical characteristics and response to psychopharmacological agents, one may distinguish two major types of anxiety disorders: panic attacks – brief, recurrent, spontaneous episodes of terror – and generalized anxiety, characterized by a long-lasting unrealistic worry. The key features of anxiety – subjective feelings ranging from a heightened sense of awareness to deep fear, overactivity of the sympathetic nervous system, a desire to escape, and avoidance behaviour – manifest themselves for each type of disorder in varying degrees. Since panic attacks respond well to antidepressants and generalized anxiety to benzodiazepines, they may reflect different alterations in synaptic functioning. For some, panic disorder is a distinct syndrome, while others maintain that panic attacks are merely manifestations of other disorders such as agoraphobia and social phobia. Whatever the case may be, there seems to be a considerable overlap between panic and phobic or specific anxiety symptoms, as opposed to generalized anxiety symptoms.

We used the computer program NOHARM II (Fraser, 1986) to ensure method equivalence with the original Manchester work. NOHARM II is, as far as we know, the only program capable of addressing multi-dimensional two-parameter latent trait models. As indicated in the Method section, the program has some limitations, in particular related to the assessment of goodness of fit, of which the distribution is unknown (Mackinnon *et al.* 1995). As a result, the interpretation of model fit is essentially relative. Another problem might be that we used a two-stage sampling procedure and did not weight back to the population. We cannot prove that this has not affected our findings. However, it is very unlikely, for two reasons. Two-stage sampling only affects results if it violates the assumption that values over the whole range should be sampled. Our sampling procedures were targeted at reducing, not eliminating, the large number of subjects with no or just a few psychiatric symptoms in the general population and primary-care attenders. The second reason is that we found the very same two-dimensional structure in the unweighted Manchester data as Goldberg *et al.* reported while using weighted data.

Our three-dimensional results differ to some

extent from Clark & Watson's (1991) tripartite model of anxiety and depression. They concluded on the basis of a thorough review of psychometric properties of anxiety and depression measures in both patient and normal samples that this tripartite structure consists of 'general distress', 'specific anxiety' and 'specific depression'. The major differences with our three-dimensional model are two-fold: (1) our dimension of (generalized) anxiety is less general than their general distress factor which includes in addition to non-specific distress also some of our depression and anxiety related symptoms; and (2) our phobic anxiety dimension is more specific than their anxiety dimension which focuses on nervous tension and autonomic symptomatology. The depression factors are roughly similar although some of the less prototypical depression symptoms are included in their general distress factor.

The results presented here suggest that a three-dimensional model of common psychiatric symptoms accounts for the shared variance among the symptoms. The depression dimension was consistent and robust. The distinction of anxiety into two uncorrelated subdimensions, generalized anxiety and phobic anxiety, needs further corroboration.

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